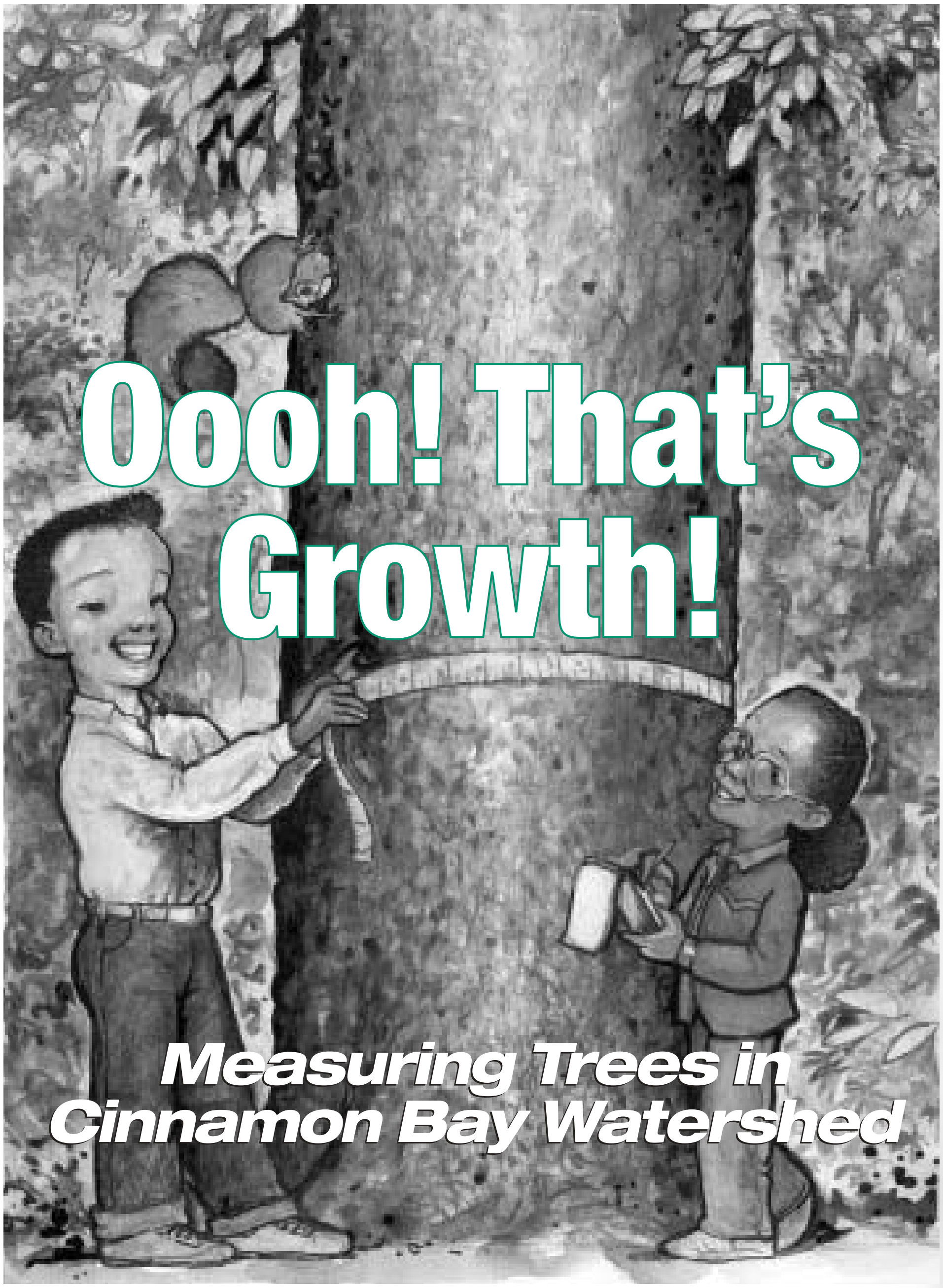
Oooh! That's Growth!

Measuring Trees in Cinnamon Bay Watershed



Meet Dr. Weaver:

I like being a scientist because I do a little bit of everything. My background has allowed me to travel, work in different cultures, learn new languages, and work with people in developing countries on many practical projects.

Dr. Weaver

Glossary:

watershed (**wä** tür shed): Land area with small streams that deliver water to a larger stream.

represent (rep re **zent**): To be an example of.

diversity (duh **vür** suh te): The quality of being different or varied.

sustainable (suh **stan** uh bul): The quality of surviving or being maintained over a specific time period.

conservation (kän sür **va** shun): The care and protection of natural resources such as forests and water.

sea level (**se** **lev** ul): The level of the surface of the sea.

elevation (el uh **va** shun): The height above sea level.

topography (tuh **pog** ruh fe): The surface features of a region, such as rivers, hills, and valleys.

diameter (di **am** uh ter): The distance equal to a straight line passing through the center of a circle, cylinder, or sphere.

species (**spë** sëz): Groups of organisms that resemble one another in appearance, behavior, chemical processes, and genetic structure.

Pronunciation Guide

a	as in ape	ô	as in for
ä	as in car	u	as in use
e	as in me	ü	as in fur
i	as in ice	oo	as in tool
o	as in go	*ng*	as in sing

Accented syllables are in **bold**.

Thinking About Science

When studying the natural environment, scientists sometimes have to wait many years to discover new things. The scientist in this study wanted to know how the trees were changing in the Cinnamon Bay *watershed*, St. John, U.S. Virgin Islands National Park (Figure 1). He was interested in knowing what kind of new trees were growing and what kind of trees were dying. He also wanted to know how fast the trees were growing. If people want to understand the natural environment, they have to know how to describe it. Usually, the best way to describe an environment is to observe it, and then to record your observations. When you know what an environment looked like one year, you can compare it with other years to tell how much it has changed.

Thinking About the Environment

The Virgin Islands National Park is located in the U.S. Virgin Islands (Figure 1). In 1976, the United Nations Educational, Scientific, and Cultural Organization (UNESCO, u **nes** ko) named the national park a Biosphere (**bi** o sfer) Reserve (re **zerv**). (The United Nations is an international organization that works for world peace and security.) A Biosphere Reserve is a special label given to natural areas around the world that *represent* the world's natural *diversity*. A biosphere reserve should be managed so that it stays healthy into the future. This is called keeping the area *sustainable*. To manage a Biosphere Reserve for sustainability (suh **stan** uh bil uh te), managers have to consider *conservation*, research, education, and whether and how to build structures for human use. All of these things must be balanced so that the area stays healthy into the future.

Figure 1. Location of U.S. Virgin Islands in the Caribbean.

Introduction

In 1718, Danish settlers moved to what is now the U.S. Virgin Islands. They cut down

Thinking About Ecology

All living things grow and develop. Think about yourself and your friends. As a living thing, you grow and develop too. Once you stop growing physically, you will continue to change and develop in other ways. When living systems such as forests stop growing bigger, they continue to develop in other ways. In this study the scientist wanted to know how the trees were growing and developing in a watershed in the Virgin Islands. By learning how the trees were growing and developing, he would know about the mixture of trees in the watershed. With this information, the scientist can help managers make better decisions about how to keep the area healthy and sustainable.

most of the trees and planted sugar cane. By 1750, almost all of the original trees had been cut down. Over time, new trees were planted or began to grow on their own. In 1917 the United States bought the Virgin Islands from Denmark. By then, only about 10 percent of the island was being used for crops, and the rest of it was again a forest. (What percentage was forested? Subtract 10 percent from 100 percent.) In 1956, the United States established a national park on one of the islands. The United Nations named the national park a Biosphere Reserve in 1976. To help manage the park as a Biosphere Reserve, the National Park Service wanted to understand how fast the trees were growing. To do this, they invited the Forest Service to do a study of the trees in the Cinnamon Bay watershed, one of the areas within the Biosphere Reserve (Figures 2 and 3).

Reflection Section

- If you were the scientist, how would you study how well the trees were growing in the Cinnamon Bay watershed?

- Why do you think the United Nations would like areas to be managed sustainably?

Figures 2 and 3. Cinnamon Bay watershed in the U. S. Virgin Islands National Park.

Method

The Cinnamon Bay watershed covers 1.32 km^2 (How many square miles is that? Multiply 1.32 X .621), and rises from *sea level* to 330 meters in *elevation* (How many feet is that? Multiply 330 X 3.28). Because the scientist could not study the entire area by himself, he decided to identify 16 smaller areas within the watershed to study. Because he wanted these areas to represent the whole watershed, he selected areas at different elevations and *topography*. (Figure 4).

How many areas have been identified in Figure 4? Compare this number with the number of areas the scientist studied. You should now realize that there was one more area identified by the scientist that is not shown in Figure 4. The scientist located the 16th area near the highest point of the watershed, at 275 meters in elevation. (How many feet is that?)

The scientist then measured the height and *diameter* of almost every tree in the 16 areas. When scientists measure the diameter of a tree,

Elevation Topography	60 meters (How many feet? Multiply 60 X 3.28)	120 meters (How many feet?)	180 meters (How many feet?)	210 meters (How many feet?)	240 meters (How many feet?)
Mountain Ridge	10 X 50 meters (How many feet?)	10 X 50 meters *For example: This area is on a mountain ridge at an elevation of 120 meters*	10 X 50 meters	10 X 50 meters	10 X 50 meters
Mountain Slope	10 X 50 meters	10 X 50 meters	10 X 50 meters	10 X 50 meters	10 X 50 meters
Valley	10 X 50 meters	10 X 50 meters	10 X 50 meters	10 X 50 meters	10 X 50 meters

Figure 4. Areas studied in the Cinnamon Bay watershed.

they always measure it at 1.37 meters (or 4.5 feet) above the ground. This measurement is called d.b.h., or diameter at breast height (Figure 5). If the d.b.h. of a tree was less than 4.1 centimeters (or 1.61 inches), the scientist did not include it in his observations. For every tree measured, the type of tree was identified and recorded. The scientist then left the area to grow for 5 years. When he returned 5 years later, he counted all of the new trees and the number of trees that had died, and measured how much the living trees had grown.

Reflection Section

- Why do you think the scientist studied areas at different elevations?

Figure 5. Research assistant measuring d.b.h. in the Cinnamon Bay watershed.

- Why do you think that scientists always measure trees at d.b.h.? (Hint: What if one scientist measured a tree's diameter at 3 meters high and another scientist measured the same tree's diameter at 4 meters? Would their measurements be the same?)

- What three kinds of information did the scientist have after he took his measurements 5 years later?

Results

After 5 years, the scientist counted 206 new trees in the 16 areas. He also found that 161 trees had died. Overall, would you say that the watershed is gaining trees or losing trees? Why? The trees grew an average of 0.07 centimeters a year when measured at d.b.h. Most of the trees grew < (less than) 0.10 centimeters a year in height (How many inches is that? Multiply 0.10 X .394) The scientist found no new tree *species* growing in the study areas.

Reflection Section

- Think about the trees where you live. In the spring, new growth appears as new stems and leaves. Compared to the trees where you live, would you say that the trees in Cinnamon Bay watershed were growing faster or slower?

- Based on the results of this research, do you think the watershed is becoming more diverse in its tree species? Why or why not?

Implications

This study will help forest managers in many ways. First, it tells them how much time will be needed for the forest to grow back if, in the future, the trees are cut down or a hurricane destroys the forest. Second, it tells scientists what kind of trees grow at different elevations in this tropical watershed. This could be especially helpful if managers want to plant trees in a similar area. Finally, this study helps managers to identify which trees are common and which are rare in the tropical watershed. It also tells managers which trees will grow to maturity, if there is no hurricane or other disturbance. You can see that by studying the current conditions of a natural area, scientists can help forest managers protect the area into the future.

Reflection Section

- Remember that the Cinnamon Bay watershed is part of the Biosphere Reserve. Go back to "Thinking About the Environment" and look at what must be balanced in a Biosphere Reserve. Which one of those four things are reported on in this article?

- Do you think the scientist should go back to Cinnamon Bay watershed in 5 more years and take more measurements? Why or why not?

FACTivity

For this FACTivity, you will answer the question: What is the relationship between tree height and d.b.h.? In other words, when trees get taller, does the d.b.h. get smaller, larger, or stay the same? You might be able to guess at the answer to this question based on your existing knowledge. What do you think the relationship is? Your guess is a hypothesis (hi̱ **paw** thuh sis). A hypothesis is an assumption that is made for the time being, so that it can be tested using planned and recorded observation. For this FACTivity, you will need a cloth (flexible) tape measure.

The method you will use to test your hypothesis is this: Go to an area that has trees of varying heights. You will first place the trees into categories, based on their height. Since you will not be able to measure the height of most of the trees, for this FACTivity you will be placing the trees in general categories. Find at least three trees in each of these categories:

- Short trees (those that are not much taller than a human)
- Medium height trees (those that are much taller than a human, but not taller than a two story-building
- Tall trees (those that are taller than a two story building

If you cannot find enough trees in these categories near your school, you may want to have your classmates take measurements of trees at home or in different places. The more trees you can measure in each of these categories, the more information you will have to answer the question.

To measure each tree's diameter at d.b.h., place the tape measure at ground level. Measure up the tree's trunk to 1.37 meters (4.5 feet). Have your classmate hold a finger at that height on the trunk. At that height, measure the circumference of the tree. The circumference is the distance around the tree trunk. For each measurement, you will have to calculate the diameter from the circumference. To do this, multiply the circumference by .3183. No matter how large the circumference, the diameter is always .3183 times the size of the circumference. Record all of your measurements. You can use the chart on the right as an example. After you have finished recording all of your measurements, you will need to determine if there is a relationship between tree d.b.h. and tree height.

To determine if there is a relationship between tree height and d.b.h., create a histogram (bar chart) from your recorded information. You can use the sample on the right to create your bar chart. See an example of a bar chart below the sample.

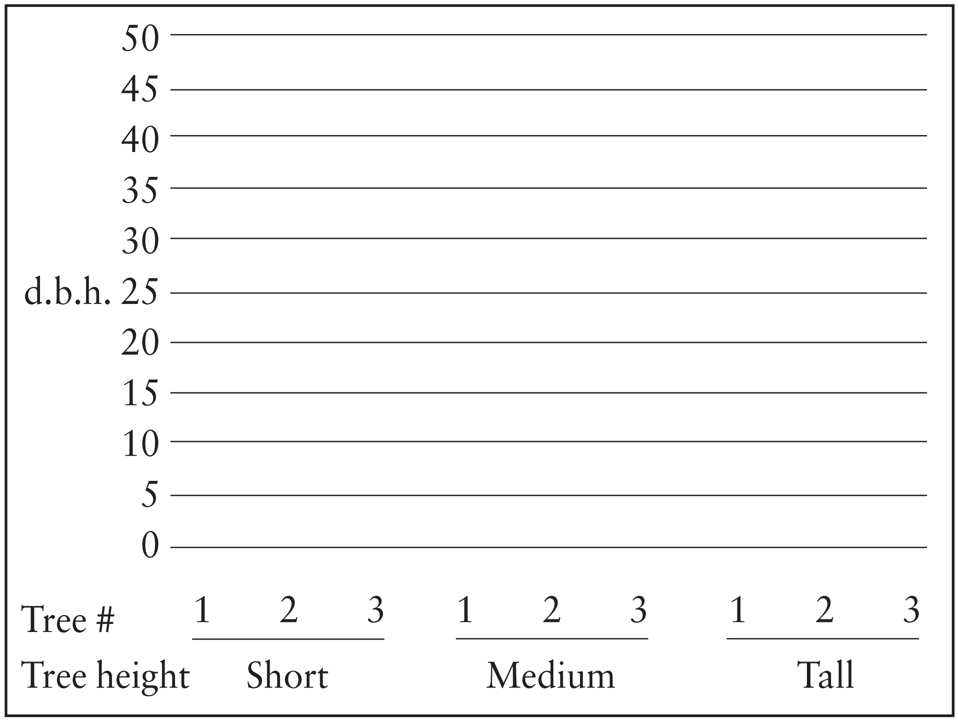
After you have made your bar chart, can you see a pattern in the d.b.h. of the trees? What is the pattern? The pattern is a relationship that you have discovered between tree height and d.b.h. Now that you know this, what is the answer to the question asked at the beginning of this FACTivity? Was your hypothesis correct?

From Weaver, P. L. (1990). Tree diameter growth rates in Cinnamon Bay watershed, St. John, U.S. Virgin Islands. *Caribbean Journal of Science*, 26(1-2): 1-6.

Sample chart for recording measurements

	Short trees	Medium trees	Tall trees
Tree #1 – d.b.h.			
Tree #2 – d.b.h.			
Tree #3 – d.b.h.			

Sample bar chart



Example of a bar chart